THE COMPARISON OF SOME ANTHROPOMETRIC, BODY COMPOSITION INDEXES AND VO2MAX OF AHWAZ ELITE SOCCER PLAYERS OF DIFFERENT PLAYING POSITIONS

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Abstract. *Purpose*: The purpose of this study was to compare some anthropometric, body composition indexes and VO2max of Ahvaz elite soccer players of different playing positions. *Material*: Participants were 60 male soccer players (age 24.31±4.20 years) from 4 teams in the two highest divisions in Iran. The sample included 8 goalkeepers, 18 defenders, 20 midfielders and 14 strikers. Anthropometric variables of subjects (height, weight and BMI) and body composition (%BF) were measured. Skinfold thickness measurements were taken using Harpenden skinfold calipers at three sites (triceps, subscapular and abdominal) and the VO2max of the subjects was estimated by participation in a multi-stage 20m shuttle-run test. One-way ANOVA and Tukey testes were used for possible differences in test variables between different player positions. *Results*: Results revealed that the goalkeepers were significantly ($p<0.05$) the tallest, heaviest and had lower VO2max than another positions. Beside the midfielders had significantly ($p<0.05$) higher VO2max than the goalkeepers. Also, no difference in estimated body fat percentage and BMI was observed between players of all positions. *Conclusion:* Thus, it can be concluded that anthropometric and physiological differences are exist among soccer players who play in different positions. These differences fit with their different workload in a game. Therefore, programs must be include specific sessions for each positional role.
Key words: BMI, Body Fat Percentage, Shuttle-Run Test, VO2max.

Introduction

Soccer is the most popular sports all over the world, and it has been practiced by every nation, without exceptions (1), and in the last few years, there is more and more interest by the biological sciences to improve the knowledge related to the soccer game through studies in several areas.

Due to the big dimensions of the game field and the duration of a match, each athlete performs a specific function within the team, as follows: goalkeepers, defenders, midfielders and strikers. According to each position and tactical pattern, the total distance ran by a player is different from the remaining, as well as the type and intensity of the actions accomplished (2-4).

The assessment and determination of the anthropometric characteristics (height, body mass and composition) is essential to a successful achievement of a soccer team not only during a game, but also along the whole sportive season, and such information can and must be used by the coach to change the player's function or even the tactical formation of the whole team, with the purpose to maximize the performance, once each positioning presents specific features (5).

During a 90-min soccer match an elite player covers on the average between 10 and 11 km per game (6-10). Although the distance covered by different players in the same position varies, studies have shown that midfielders travel farther than goalkeepers, defenders or strikers, probably because of their linking role in the team (6,8,10). Studies on the physical performance of elite soccer players indicate that the average maximal O2 uptake ranges between 56.8 and 67.6 $mL \cdot kg^{-1} \cdot min^{-1}$ (6,7,11-17.

Nevertheless, aerobic power has been well recognized as an important physiological contributor to soccer performance (7,18). Previous studies have demonstrated a significant relationship between distance covered during the game and the players maximum aerobic power (11,19).

Since the physiological as well as physical characteristics are rather important in players' performance (19), it may therefore be assumed that anthropometric and VO2max measurements may differ between footballers of different playing positions, for instance forward, goalkeeper, back and halfback. Consequently, differences in the physical characteristics of footballers of different playing positions within teams are also worth investigating.

Thus, the purpose of this study was to assess the anthropometric profile, body composition and VO2max of elite soccer players, and to verify if there is any difference between their positioning (goalkeepers, backs, halfbacks and forwards) among the assessed variables.

Materials and Methods

The study was approved by the Human Research Ethics Committees of Shahid Chamran University of Ahwaz. Subjects were included 60 elite players (age mean 24.31±4.20 year) from 4 Ahwaz soccer teams (these teams participated in the super and the first Iran soccer league in session 2008-2009), divided according to their field positioning: 8 goalkeepers, 18 defenders, 20 midfielders and 14 strikers.

Anthropometric and body composition measurements

Weight (kg) was measured with Seca digital scale to the nearest 0.1 kg.

Height was measured using a wooden stadio-meter (20,21) to the nearest 0.5 cm.

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Skinfold thickness measurements were taken with Harpenden skinfold caliper (British Indicators, UK) to the nearest 0.1 mm. The formula used to attain the body fat percentage was proposed by FAULKNER (%BF = Σ of the skin folds × 0.153 + 5.783) using the tricipital, subscapular, and abdominal folds (21).

Body mass index (BMI, $kg \cdot m^{-2}$) was calculated as the mass (kg) divided by the squared height (m).

VO2max measurements

As a guide to overall fitness, the subjects participated in a multi-stage 20m shuttle-run test to estimate their VO2 max (22). After familiarization, the tests were performed in groups to ensure maximal effort by stimulating competition.

Following personal warm up routines, the test commenced with a four second countdown after which the tape emitted a single beep at regular intervals. The subjects had to reach the end of the 20m course by the time the next beep sounded. They then proceeded to run back and forth along the 20m reaching either end of the course every time a beep was emitted from the cassette recorder. After each minute, the span between the beeps decreased leading to a proportional increase in running speed of 0.14 m/second.

Every minute spent running was termed "another level".

Each subject ran for as long as was possible before voluntarily withdrawing when they could no longer keep up with the pace set by the tape. Subjects failing to reach the end of the 20m run twice before the beep sounded was withdrawn. The number of levels and shuttle runs completed were noted at the time the subject retired. Maximal oxygen uptake values were then predicted using the tables of Leger & Lambert (1982) (22) based on the relationship between VO2 max and the maximum speed achieved in the multi-stage shuttle run.

The shuttle-run test was performed on the Takhti stadium in Ahwaz of Iran.

Statistical analysis

SPSS (version 17.0) was used for the statistical analysis. Players in the study were classified as strikers, midfielders, defenders, and goalkeepers. The most common playing formation was 4-4-2 (four defenders, four midfielders, and two attackers), although 3-5-2 and 4-5-1 were also seen. A one-way ANOVA and Tukey Test were used for possible differences in test variables between different player positions (goalkeepers, defenders, midfielders, and strikers). P values < 0.05 were considered as statistically significant.

Results

Table 1 presents the results related to the anthropometric, body composition and VO2max data. Goalkeepers was significantly taller than defenders (p=0.034), midfielders (p=0.001), and strikers (p=0.003) and defenders was significantly taller than midfielders (p=0.004). Goalkeepers was significantly heavier than defenders (p=0.003), midfielders (p=0.001), and strikers (p=0.001). Midfielders had significantly higher VO2max than goalkeepers (p=0.005). Also, no difference in estimated body fat percentage and BMI was observed between players of all positions.

Table 1

Anthropometric, body composition indexes and VO2max in Iranian elite soccer players

Positioning	Height)cm(	Weight)kg(	BMI)m/kg²(	Body fat)%(	VO2max (ml.kg⁻¹min⁻¹)
Goalkeepers (n = 8)	b 1.87±0.04 1.94 1.80	b 85.18±4.1 92.10 80.53	24.24±1.16 22.63 25.98	12.25±1.30 13.74 9.61	a 55.73±2.93 59.66 50.45
Midfielders (n = 20)	1.75±0.05 1.86 1.67	72.35±4.54 82.50 66.32	23.45±1.04 25.01 20.53	10.71±1.12 12.71 8.86	60.69±3.55 66.29 54.12
Strikers (n = 14)	1.79±0.05 1.89 1.70	73.76±8.90 87.40 58.00	22.93±2.00 25.98 19.16	10.84±1.65 14.79 8.54	59.71±3.16 65.60 54.01
Defenders (n = 18)	a 1.81±0.04 1.90 1.73	75.78±5.66 85.14 64.50	22.89±1.29 24.78 20.66	11.17±1.67 13.74 8.86	57.89±3.57 65.30 51.35
All Players (n = 60)	1.79±0.06 1.94 1.67	75.40±7.14 92.10 58.00	23.27±1.42 25.98 19.16	11.08±1.50 14.79 8.54	58.96±3.73 66.29 50.45

a Significantly different from midfielders ($P < 0.05$). b Significantly different from players of other positions ($P < 0.05$).	Mean and SD Vmax Vmin

Discussion

The anthropometric profile in soccer professional players can be characterized by its heterogeneity, and this may be partially explained by the ethnic and racial differences of its practitioners (1,5). The present results on player height, weight, BMI, %BF and VO2max are in accordance with previous studies on elite soccer players.

In this study, it was verified that goalkeepers and defenders are taller compared to other analyzed athletes, and such data was also found in several studies evidencing such trend (1, 3, 23-27). In order to a team to be successful, it is essential that goalkeepers have a privileged height, Because the important tasks of a goalkeeper are to react and move quickly, to a higher amount of jump or dive to save or deflect shots, and to cover a large perimeter (2.44 × 7.32 m).

We observed very few differences between the three groups of outfield players, defenders, midfielders, and strikers. Defenders were significantly taller than midfield players, which can be taken as an indication that size is an advantage in this position to be able to reach high balls in their defensive role and perhaps to increase their reach in tackling duels, as well. Opposite to this, midfielders and strikers are shorter and rather run with the ball, and they are quicker, and this fact grants to them an additional advantage against the defenders (11, 28).

As to the body weight, goalkeepers have shown to be heavier than the other assessed positions. These results are similar to the ones found by several authors from several countries, who also attained the same answers (14,23,24,27,29,30,). The behavior of this variable seems to partially explain the lower distance they run, besides of their specific role during a game (4, 11, 15, 26), trend to present a higher percentage of body fat by a lower metabolic energy cost both in gaming days and along training sessions (3, 26), have a higher amount of muscular by requiring to much explosive power and be taller than players of other positions. In this the study, there was not differences in BMI between different playing positions that such data are in accordance with previous studies on elite soccer players (24, 27,31,32).

The body composition is a very important aspect to the physical ability level of the professional athletes in any modality, as the fat surplus can substantially decrease the human performance (Reilly, 2003). It was observed in the present study no differences in the percentage of body fat among the assessed positions, and such data are in accordance to other found in literature (23, 27, 31), but some previously mentioned researches (14, 25, 29, 30) have shown that the goalkeepers have a higher percentage of body fat due to a lower metabolic energy cost both in gaming days and along training sessions then players of other positions (3, 26).

It can be seen clearly in literature (11, 14, 17, 18, 23, 32, 33) that the midfielders always have highest VO2max and the goalkeepers have lowest VO2max in compared with players of other positions but there are not differences in VO2max between midfield players and strikers or defenders. Our comparison between different playing positions related to VO2max showed that the goalkeepers had a lower VO2max than players of other positions because they present much more anaerobic strength and power both in gaming days and along training sessions than midfielders with an excellent aerobic ability level, indicating that running ability and aerobic power are less important for them. We did not find a difference in VO2max between midfield players and strikers or defenders but the midfielders had the highest VO2max. Midfielders cover greater total distances than any other players in the other positions. The midfielders must have high level of aerobic fitness because they perform both defensive and offensive roles and are always required to make long run (19).

Conclusion

The results obtained in this study suggest that there are anthropometric differences between athletes, according to their assessed positions, and the correct use of these individual differences in behalf of the team can contribute to the sportive success. We observed very few differences between the three groups of outfield players, defenders, midfielders, and strikers but Goalkeepers demonstrated different physical and physiological characteristics from outfield players. The small differences observed in physical and physiological fitness between players in different player positions (outfield players) is perhaps not surprising, because in modern soccer each outfield player assumes a larger role in the overall play of the team, so the positional differences are less than previously seen.

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